

We claim:

1. An integrated wavelength router comprising  
a demultiplexer arranged to couple individual wavelengths in an input optical  
5 WDM signal to N respective demultiplexer outputs,  
a binary tree including at least first and second stages of interconnected  $1 \times 2$   
switches, each of the switches in said first stage arranged to couple one of said N  
outputs of said demultiplexer to inputs of at least two switches in said second stage,  
and  
10 a plurality of K multiplexers arranged to combine the outputs from a plurality of  
switches in said second stage to form K outputs of said router.
2. The invention defined in claim 1 wherein the outputs of each switch are  
waveguides crossing each other to form inputs to the switches in the next stage.
3. The apparatus of claim 1 wherein said demultiplexer, said binary tree, and said  
15 multiplexers are all formed in a planar arrangement on one or more substrates.
4. The apparatus of claim 3 wherein the demultiplexer and said multiplexers are  
waveguide grating routers.
5. The apparatus of claim 3 wherein said switches are Mach-Zehnder  
interferometers.
- 20 6. The apparatus of claim 5 wherein said switches are activated thermooptically.
7. The apparatus of claim 1 in which the outputs of said multiplexers are  
connected to an  $N \times N$  waveguide grating router.
8. The invention defined in claim 1 further including a plurality of shutters  
disposed before the inputs of said multiplexers.
- 25 9. An integrated wavelength router comprising  
a binary tree comprising at least first and second stages of interconnected  $1 \times 2$   
switches,  
a demultiplexer arranged to couple N individual wavelengths in a WDM optical  
signal to inputs of respective switches in said first stage, and  
30 a plurality of K multiplexers arranged to combine outputs from a plurality of  
switches in said second stage to form outputs of said router.

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10. A router comprising

a binary tree containing  $\log_2 K$  stages of interconnected  $1 \times 2$  switches,  
a demultiplexer arranged to receive an input WDM signal containing  $N$   
wavelengths, and apply  $N$  separated wavelengths to inputs of switches in a first of said  
5  $\log_2 K$  switch stages, and

$K$  multiplexers arranged to combine outputs from switches in the last of said  
 $\log_2 K$  switch stages to form  $K$  outputs of said router.

11. The router of claim 10 wherein said switches are integrated in a planar  
arrangement on one or more silica substrates, and wherein the outputs of the switches  
10 in each of said stages cross each other before being connected to inputs of the switches  
in the next stage.

12. The router of claim 10 further including a plurality of shutters interposed  
in the paths leading to the inputs of said multiplexers.

13. The invention defined in claim 10 wherein the outputs of each switch  
15 are waveguides crossing each other to form inputs to the switches in the next stage.

14. The apparatus of claim 10 wherein said demultiplexer, said switches  
and said multiplexers are all formed in a planar arrangement on one or more  
substrates.

15. The apparatus of claim 14 wherein the demultiplexer and said  
20 multiplexers are waveguide grating routers.

16. The apparatus of claim 14 wherein said switches are Mach-Zehnder  
interferometers.

17. The apparatus of claim 16 wherein said switches are activated  
thermooptically.

25 18. The apparatus of claim 10 in which the outputs of said multiplexers are  
connected to an  $N \times N$  waveguide grating router.

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